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# Forest Research Berea, Kentucky

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U.S. DEPT. OF AGRICULTURE  
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Respect for natural resources is basic to USDA Forest Service philosophy and practice, as it is to the innovative, energy-efficient Forest Service facility at Berea, Kentucky. Built to use the sun's energy and incorporate many passive energy-saving features, the Berea laboratory is a fitting structure to house employees devoted to the wise use of the Nation's natural resources.

Solar panels on the roof draw and store the energy that supplies 60 percent of the laboratory's heat, air conditioning, and hot water. The exterior design, with its extensive use of wood, reflects the building's natural, but functional, character.

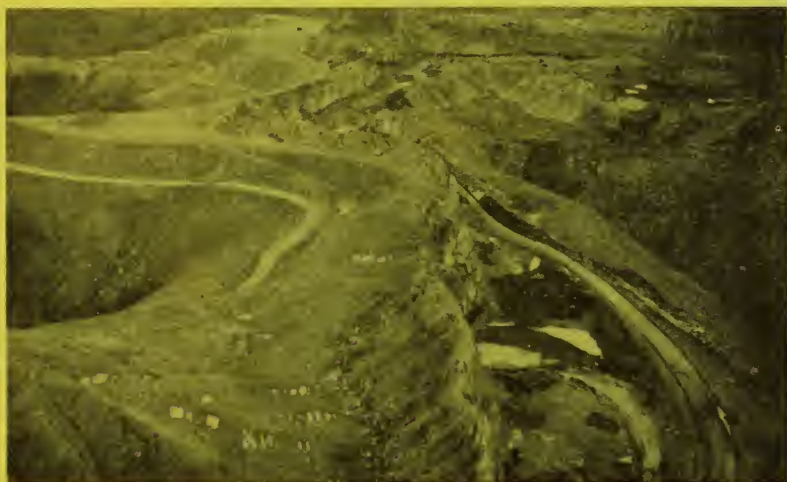
The structure is set into a hillside and with 48 percent of its exterior walls underground is protected and insulated against extremes of heat and cold. A southern exposure increases benefits from the sun's energy. The roof and window louvers are angled to block the summer sun and allow winter rays to penetrate. Inside the 22,000-square-foot research facility, wood- and gas-fired hot water boilers are used as a backup source of energy.

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Achieving energy independence by the end of this century is a national priority, but we can reach this goal only by drawing more heavily on the Nation's vast coal reserves. Today, nearly 70 percent of the coal consumed in the United States is produced by surface mining. This means that thousands of acres of land will be disturbed each year to meet projected annual demands for coal through this decade — a whopping 1.4 billion tons by 1990.

Surface mining of coal begins with a series of blasts of sufficient force to shatter deep layers of rock and topsoil that have formed over thousands of years. Breaking up these strata of rock and soil — the overburden — exposes the underlying coal deposits but also generates tons of rock fragments and other debris on surface-mined lands. This material, or spoil, undergoes physical and chemical changes which, when combined with steep slopes, can result in a highly unstable surface. Sediment and acidic or toxic elements may move into and pollute streams, endangering fish and plant life and possibly contaminating supplies of drinking water.

But this devastation need not be permanent. Surface-mined lands can be restored to productive use and original beauty through planned mining operations and effective reclamation practices. This restoration is



*Environmental disturbance from mining begins with the construction of roads into the mine site, and often continues long after the last load of coal has been removed.*





*Ordered layers of topsoil and rock are rearranged during mining.*



*Unattended, the resulting mix may shift and erode, and some form toxic wastes that pollute water supplies.*



*Left to Nature, the scars heal slowly.*



*But with proper attention to reclamation, productivity of the land is rapidly achieved.*

a major concern of the USDA Forest Service, which is responsible for managing 187 million acres of National Forest and Grasslands. In the Eastern U.S., more than 1 million acres of national forest land are subject to surface mining under existing Federal regulation. And 90 percent of the 300,000 acres disturbed by surface mining in 1980 were located in the East.

The Northeastern Forest Experiment Station's laboratory at Berea, Kentucky, houses the country's most comprehensive research effort on surface-mine reclamation. Scientists at Berea are developing practical and cost-efficient methods to reduce damage to the environment and forest resources from surface mining, and to reclaim newly mined and abandoned mined areas for the benefit or enhancement of water quality, timber, wildlife, recreation, range, and esthetic values.



*Researchers identify fast-growing, acid tolerant, drought resistant, and less competitive species to help achieve rapid cover on surface-mined sites.*





*Soon this quick cover species gives way to the preferred vegetation.*

The primary objectives of researchers at Berea are to:

- Gather information on overburden and spoil properties.
- Ameliorate adverse effects of surface mining and associated activities on water quality.
- Develop techniques for revegetating with woody species.
- Minimize the adverse effects of reclamation activities on productivity and landscape quality.

Gathering, analyzing, and interpreting data on overburden and spoil properties will allow controlled placement of spoils in many areas and may substantially reduce costs for proper reclamation by reducing requirements for soil amendments. Such data also will enhance revegetation and reduce the need for costly replanting, and alleviate chemical pollution of streams by eliminating some of the exposure of toxic materials to the processes of weathering and leaching.



*In natural succession, trees and shrubs gradually overtop herbaceous species. To hasten the process and assure trees of a strong start, researchers recommend planting trees and grasses in strips. This pattern also discourages erosion.*

Research on the effects of surface mining and reclamation on streamflow and water quality is important in coal mining regions where Federal and State regulations require procedures that “minimize changes to the prevailing hydrologic balance.” Factors that affect leaching of minerals must be understood so that methods of control can be developed. The effects of topsoiling, revegetation techniques, and spoil configuration must be investigated because they affect erosion, water quality, and streamflow. The ability to predict runoff and erosion as well as formation of acid-mine drainage under different spoil placement schemes may make it possible for many mines to remain open. Understanding the causes and effects and devising preventive or corrective techniques could be of untold benefit to downstream users of water affected by mine drainage.

Guidelines are being developed for revegetating surface-mined lands with woody species. Herbaceous cover is required on surface-mined lands to control runoff and erosion, and methods for accomplishing this are reasonably well established. However, practical and economical methods are not yet available to establish tree and shrub species in conjunction with herbaceous cover on areas where wildlife

habitat and forestry are the designated postmining land uses. Results of improved revegetation techniques will allow for more efficient reclamation planning, the effects of which should result in more productive land and added protection for streams against sediment and chemical pollution. At the same time, reclamation costs could be reduced and land values increased. The high percentage of forest-land conversion to other postmining land uses could be reduced significantly.

Scientists at the Berea laboratory also are delineating and evaluating the effects of surface-mining and reclamation alternatives on landscape quality. Efforts in mining and reclamation must be directed toward achieving a balance among coal production, alternate future uses of the land, and landscape quality. The overall purpose is to attain the highest possible visual quality commensurate with other appropriate environmental objectives, uses, costs, benefits, and commodity production.

Surface-mining and reclamation research at Berea is conducted through an interdisciplinary team effort. Scientists there cooperate with many individual landowners, mine operators, and mine industry associations. They also work closely with many Federal and State agencies. The laboratory's activities are coordinated with those of Forest Service units in the West that are engaged in similar reclamation work. Cooperation also is maintained with numerous universities. The Northeastern Area,



*Once established, trees grow rapidly. Soon, a new forest, and new life for mined land.*





*Properly designed impoundments on the mined land itself can be effective in controlling runoff and preventing stream siltation.*





*With renewed life come renewed utility and productivity. Reclaimed land provides recreational opportunities, pasture, wildlife habitat, and forests.*

State and Private Forestry has located a technology transfer specialist at Berea to speed the rate at which the research findings are applied.

These research problems are only a few of the many that have been addressed through more than 20 years of reclamation research. Questions or requests for publications on current or past research should be directed to the Forestry Sciences Laboratory at Berea.

